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*G. C. Gray  
G. D. Gackstetter  
H. K. Kang  
J. T. Graham  
K. C. Scott*

20040121 041

*Report No. 00-26*

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NAVAL HEALTH RESEARCH CENTER  
P. O. BOX 85122  
SAN DIEGO, CA 92186-5122

BUREAU OF MEDICINE AND SURGERY (MED-02)  
2300 E ST. NW  
WASHINGTON, DC 20372-5300



## **Gulf War Veteran Healthcare Utilization: After More than 10 Years of Study, What Have We Learned?**

Gregory C. Gray,<sup>1,6</sup>

Gary D. Gackstetter,<sup>2</sup>

Han K. Kang,<sup>3</sup>

John T. Graham,<sup>4</sup>

Ken C. Scott<sup>5</sup>

<sup>1</sup> Department of Epidemiology  
College of Public Health  
University of Iowa, Iowa City, IA

<sup>2</sup>The Uniformed Services University of the Health Sciences  
Bethesda, MD

<sup>3</sup>The Environmental Epidemiology Service  
Department of Veterans Affairs  
Washington, DC

<sup>4</sup>British Liaison Officer (Gulf Health)  
Defence Staff, British Embassy  
Washington, DC

<sup>5</sup>Director of Medical Policy  
Canadian Forces, Ottawa  
Ontario, Canada

<sup>6</sup>Naval Health Research Center  
San Diego, CA

April 25, 2003

Report 00-26, supported by the Office of the Assistant Secretary of Defense, Health Affairs, under DoD/HA reimbursable funds work unit no. 60002. The views expressed in this article are those of the authors and do not reflect the official policy or position of the Department of the Defense, Department of Veterans Affairs, the US Government, the Ministry of Defence or the British Government. Approved for public release, distribution unlimited. This review has been conducted in compliance with all applicable Federal Regulations governing the protection of human subjects in research.

## INTRODUCTION

Soon after returning from the Gulf War conflict, veterans from the United States, United Kingdom, and Canada became concerned that their symptoms and illnesses were due to military service.<sup>(1-3)</sup> After two United States (US) epidemic investigations<sup>(4,5)</sup> were unable to construct a case definition of a war-related syndrome or to implicate specific wartime exposures, special healthcare registries were established to systematically evaluate the health of Gulf War veterans (Table 1). As of June 2002, more than 120,000 US, United Kingdom (UK), and Canadian Gulf War veterans have been systematically evaluated under these clinical programs. In conjunction with the health registry evaluations, the US, UK, and Canada commissioned numerous medical research projects to examine whether postwar morbidity was associated with Gulf War service.<sup>(10, 11)</sup> Additional investigative efforts have been made to understand these illnesses through numerous external panel reviews and a large risk management organization. It has been estimated that in total more than 1 billion dollars has been invested in understanding and treating Gulf War veterans' illnesses (COL James R. Riddle, USAF, Executive Secretary of the Armed Forces Epidemiological Board).

We sought to summarize what has been learned from these efforts. As other authors have recently reviewed various studies of Gulf War veterans' health including mortality studies,<sup>(12)</sup> symptom studies,<sup>(13)</sup> infectious diseases reports,<sup>(14)</sup> and healthcare policy changes,<sup>(15,16)</sup> we narrowed our review to studies involving Gulf War veteran healthcare utilization.

## METHODS

We used MEDLINE, Expert Panel Reports, Reports to Congress, and a topical Gulf War veteran bibliography with 5520 references<sup>(17)</sup> to identify published research, and ongoing research relevant to the objectives. We summarize their findings herein.

## RESULTS

### *Gulf War veteran healthcare registry studies*

A number of research teams have evaluated Gulf War veteran healthcare registry data.<sup>(7,8,18-21)</sup> Because of volunteer bias, sensational media reports, recall bias, and other potential confounders of self-reported information,<sup>(18, 20, 22)</sup> these data are limited in their epidemiological value. However, the registry data have been very useful in documenting both the wide spectrum of self-reported symptoms and the most commonly recorded diagnoses. Additionally, the healthcare registry programs have improved Gulf War veteran access to medical care.

The methodology and findings of the US Department of Veterans Affairs (VA) and Department of Defense (DoD) healthcare registry evaluation processes have been

previously summarized in detail.<sup>(7, 19)</sup> In brief, enrollment for registry evaluation is gained by directly contacting nearby VA or DoD medical facilities or via toll-free telephone calls for appointment. Participants normally receive an initial screening examination by a primary care healthcare provider. Veterans also complete a questionnaire that enumerates medical conditions, symptoms, and possible exposures. After the initial evaluation, some Gulf War veterans may be referred for additional diagnostic procedures involving clinician-directed screenings for various immunologic, metabolic, rheumatogenic, infectious, and mental health conditions.

The UK medical assessment program<sup>(8)</sup> similarly offers veterans and their partners an evaluation by a consultant physician. Before the appointment, available service medical records are retrieved. During the consultation, patients complete a short questionnaire about their military service and relevant experiences in the Gulf, including exposure to potentially harmful factors. A detailed history is then obtained, and a clinical examination is conducted to include a complete blood count, blood chemistry tests, serology for a number of infectious agents, urinalysis, electrocardiography, chest radiography, abdominal ultrasonography, and lung function tests. Further investigations are conducted if clinically indicated. The results of the clinical examination and investigations are sent to the patient's general practitioner. Referral to a specialist, if indicated, is either arranged within the Defence Medical Services or, if the veteran has left military service, recommended to the patient's general practitioner.<sup>(8)</sup>

The Canadian Gulf War Registry was established in January 1995. Veterans with or without medical problems were evaluated at the local base level. If a diagnosis was reached and the member and examining physician were satisfied, no further workup or referral was done. However, if the member or examining physician requested further assistance, a referral could be made to a single Gulf War Clinic located in Ottawa, Ontario. At the Gulf War Clinic, 104 veterans were evaluated, with comprehensive examinations and laboratory testing lasting on average 3 hours. The Canadian Gulf War Clinic closed in December 1997. After seeing 226 veterans, the Gulf War Registry ceased recording new entries as of January 1998. Since then, approximately 20 additional veterans have been evaluated by multiple Post-Deployment Clinics across Canada.

The first peer-reviewed Gulf War registry clinical series was published by DoD medical personnel in early 1997.<sup>(7)</sup> The authors reported a wide range of symptom reporting and clinical diagnoses, concluding that no predominant illness or suggestion of a new syndrome could be found. Their summary of evaluations conducted at 184 different medical treatment facilities was important in demonstrating the prevalence of the types of commonly reported symptoms and commonly diagnosed conditions among those who chose to be evaluated.

In 1998, DoD and VA investigators published a risk factor analysis of participation in either the DoD or VA healthcare registries.<sup>(18)</sup> Evaluating 74,653 registry participants, the study demonstrated that Gulf War veterans who were Army personnel, National

Guard and Reserve personnel, older Gulf War veterans, and personnel hospitalized before the war were most likely to seek healthcare evaluations. About 28% of registry participants were not given a specific diagnoses. The authors also identified a possible association between registry participation and news stories involving Gulf War veterans.

A summary of the United Kingdom's findings with its first 1000 registry evaluations was published in 1999.<sup>(8)</sup> Many Gulf war veterans had a wide variety of symptoms. This initial review showed no evidence of a single illness, psychological or physical, to explain the pattern of symptoms seen in veterans in the assessment program. More than one half of the veterans had more than one diagnosed condition. One third had at least one condition for which no firm somatic or psychological diagnosis could be given. In approximately 10% of veterans, no other main diagnosis was made. Conditions characterized by fatigue were found in one quarter of patients. Post-traumatic stress disorder was diagnosed in approximately 10% of patients.

The largest number of Gulf War veteran registry evaluations has been conducted at VA medical treatment facilities. A 1999 review of data from 52,835 VA registry participants listed a wide variety of symptoms and diagnoses without an apparent internal variation by military characteristics, such as branch of service (Army, Navy, Air Force, Marines) and service component (active, Reserve, National Guard).<sup>(19)</sup> The frequency of major self-reported symptoms (fatigue, skin rash, headache, muscle and joint pain, and memory loss) showed an increasing trend over a 2.5-year evaluation period (August 1992 to July 1995), but the proportion of veterans who received a physician's diagnosis of any medical condition remained fairly constant at about 72% to 76% during the same period. No single category of disease increased or decreased substantially over time. Among these veteran participants, the most frequent complaints included fatigue, skin rash, headache, muscle and joint pain, cognitive complaints, shortness of breath, sleep disturbances, diarrhea and other gastrointestinal symptoms, and chest pain. A significant proportion of veterans had no health complaints at the time of their registry examination and just wanted to participate. Within the broad diagnostic categories, the most frequently diagnosed medical conditions were diseases of musculoskeletal and connective tissue, followed by mental diseases, diseases of the respiratory system, skin and subcutaneous tissue diseases, and digestive diseases.

Reviewing existing data and reports, the most frequently reported symptoms and diagnoses from the four registries were remarkably similar. Fatigue, rashes, headache, muscle and joint pain, and cognitive problems were all quite common (Table 2), as were related, often nonspecific, diagnoses (Table 3). These findings have been important in consistently demonstrating the broad spectrum of symptoms and illnesses Gulf War veterans have experienced and their similarity to the clinical findings from other nonmilitary adult outpatient populations.<sup>(23)</sup>

Gulf War veteran registries have also been used to examine self-reported symptom and exposure data for possible illness associations and to evaluate the etiological nature of increased symptom reporting. In a June 1998 report, Kroenke et al.<sup>(23)</sup>

examined records from 18,495 DoD evaluations and concluded that the latency of symptom reporting (often more than 1 year after the war) and the poor correlation with self-reported war exposures did not support the hypothesis that a specific exposure(s) resulted in postwar symptoms. In a 1998 case series, Escalante and Fischback<sup>(24)</sup> tabulated the rheumatic manifestations of 145 VA registry participants who were referred for rheumatological evaluation. The authors noted that the types of conditions Gulf War veterans experienced after the war were not unusual (e.g. fibromyalgia, nonspecific arthralgias, osteoarthritis) and they inferred no suggestion of a new Gulf War-related syndrome. Two other teams of researchers<sup>(25, 26)</sup> studied a total of 457 Gulf War veterans evaluated for possible rheumatological conditions and noted a high prevalence of common conditions, also suggesting no unique Gulf War diagnosis or condition. Among the first 65 DoD registry patients seen for neurological symptoms at one medical treatment facility during 1994, Newmark et al.<sup>(27)</sup> found no consistent patterns of neurologic disease. In 1998, Roy et al.<sup>(28)</sup> studied registry data from 12,744 DoD registry participants who had principal or secondary diagnoses coded in the "signs, symptoms, and illdefined conditions" diagnostic category of the International Classification of Diseases, 9th revision (ICD-9).<sup>(29)</sup> They noted that many of the diagnoses in this category represented common symptoms and concluded that there was no evidence of a new syndrome. In a 1999 report, Kipen et al.<sup>(30)</sup> surveyed 1935 VA registry participants and found that 16% of registry participants reported vague symptoms consistent with chronic fatigue syndrome, further suggesting no evidence of a new disease entity.

In contrast to the above-mentioned reports of no unusual morbidity, Das et al.<sup>(31)</sup> performed pulmonary function testing (with bronchoscopy studies on 17) on a case series of 48 VA Gulf War veteran participants referred for pulmonary medicine evaluation. The authors reported a higher than expected midvital flow capacity with the suggestion of chronic inflammation of upper airways. They speculated that these findings may be chronic manifestations of exposure to smoke and/or other irritants from the Kuwaiti oil well fires during the war. Additionally, after seeing 16 Gulf War veteran females in his gynecology clinic for the DoD registry, Wittich<sup>(32)</sup> concluded that a high proportion had gynecological problems during and after service in the Gulf.

### *Hospitalizations Studies*

In-theater hospitalizations. Data are sparse regarding in-theater Gulf War hospitalizations. Electronic records were not routinely kept and some inpatient medical records have only been recently located. Wintermey and colleagues reviewed 574 admissions among US servicemen and Iraqi prisoners at an Army support hospital during the War. They concluded that hospitalization rates fluctuated with combat and that care to both US soldiers and Iraqi prisoners was of similar quality.<sup>(33, 34)</sup> Burkle et al. reviewed activities of two military field trauma centers located in Kuwait during the ground war and found that soldiers injured by land mines were most in need of emergency resuscitation.<sup>(35)</sup> Recently, the Office of the Special Assistant for Gulf War

emergency resuscitation.<sup>(35)</sup> Recently, the Office of the Special Assistant for Gulf War Illnesses has made efforts to aggregate in-theater hospitalization records and electronically code admission data so that more detailed assessments may be possible.

Postwar hospitalization studies of electronic data. A number of controlled epidemiological studies of DoD hospitalizations have aided veterans and public health policymakers in examining evidence for increased postwar morbidity among Gulf War veterans. The first such study, published in 1996, compared Gulf War veterans and nondeployed veterans for postwar hospitalizations during 25 months after the war.<sup>(36)</sup> Adjusting for a number of covariates, including prewar hospitalization experience, Gulf War veterans who remained on active-duty were found to have increased postwar odds of hospitalizations in 5 of 45 multivariate statistical models. However, these differences were not consistent over the 25 months of study and were likely due to deferred medical care or other well understood postwar conditions.

DoD hospitalizations have also been studied for evidence that Gulf War veterans may be more prone than their non-deployed peers to suffer certain postwar diagnoses. Knoke et al.<sup>(37)</sup> examined the postwar diagnoses of the most common cancer among young males, testicular cancer, and found no evidence of increased risk among Gulf War veterans. In another study<sup>(38)</sup> the same team of investigators performed an epidemiological comparison to compile evidence of hospitalizations due to a new or as yet unidentified condition. Using an aggregate of 77 ICD-9 diagnoses previously identified by the Centers for Disease Control and Prevention in monitoring for unexplained deaths, they again compared regular active-duty Gulf War veteran and nondeployed veteran hospitalizations in DoD facilities. During the 50-month postwar period they found an increased hospitalization risk among Gulf War veterans beginning late in 1994. However, upon closer scrutiny, this increase was noted to be artificial and due to hospitalizations for non-medical reasons in support of the DoD's Gulf War veteran registry program in which veterans were admitted as inpatients in order to complete their diagnostic evaluation, not because they were ill.

Similarly, DoD hospitalization data were examined for evidence of unusual mental health morbidity that might be associated with the war. Dlugosz et al.<sup>(39)</sup> examined 30,539 initial mental health hospitalizations from June 1991 through September 1993 and found that Gulf War veterans were more likely to be admitted for alcohol-related disorders, drug-related disorders, and acute reactions to stress than their non-deployed peers. The strongest predictor of postwar mental health hospitalization was prewar mental health hospitalization. With the exception of alcohol-related disorders, the authors found no association between service in combat units during the Gulf War and risk of postwar mental health hospitalization. Rothberg et al. similarly found moderate but transient increases of postwar ambulatory mental health or social problems among Gulf War veterans at one medical treatment facility in the Southeastern United States.<sup>(40)</sup>

Smith et al.<sup>(41)</sup> compared Gulf War veterans with non-deployed veterans for the onset of three postwar conditions: systemic lupus erythematosus, amyotrophic lateral sclerosis, and fibromyalgia. Examining DoD hospital data from October 1988 through July 1997, they found no evidence that Gulf War veterans were more likely than their peers to be hospitalized for any of the three conditions.

### MENTION ALS STUDY

Most recently, Blood et al.<sup>(42)</sup> compare the postwar hospitalization experience of US Marine deployed to the Gulf War with similar Marines deployed to the Vietnam conflict. They found similar hospitalization rates for both cohorts and no unexplained differences in the proportional distribution of diagnostic categories.

Because the hospitalization studies previously mentioned captured only data from personnel who were eligible for DoD hospital care, a comparison of Gulf War veteran and nondeployed veteran hospitalizations was published in 1998 using DoD, VA, and California nonfederal hospitalization data.<sup>(43)</sup> These analyses captured data from Reserve, and National Guard personnel, as well as former military personnel who no longer were eligible for federal healthcare. Because investigators were unable to determine accurate denominators for the VA and California hospital systems, they instead relied upon proportional morbidity ratios in making comparisons. There was no evidence that Gulf War veterans were suffering increased hospitalizations for infectious diseases, cancers, endocrine diseases, nervous system diseases, blood diseases, circulatory system diseases, musculoskeletal diseases, or skin conditions. However, Gulf War veterans had proportionally more hospitalizations for fractures, and bone and soft tissue conditions in DoD and California hospitals, and for respiratory diseases, digestive diseases, and vague symptom diagnoses in VA hospitals. The authors concluded that while these findings are biologically plausible, they may simply be the result of as yet unidentified confounding risk factors, and they should be validated with further studies.

#### Postwar hospitalizations studies of cross-sectional survey data.

Postal surveys of military and former military personnel are another approach to comparing hospital morbidity among Gulf War veterans and their nondeployed peers. However, this method is more prone to several forms of bias. Kang et al.<sup>(44)</sup> reported that among the 11,441 Gulf War veterans and 9,476 nondeployed veterans they surveyed in 1996 and 1997, the proportion reporting a hospitalization due to illness during the last year was higher among Gulf War veterans (rate ratio = 1.22; 95% confidence interval (CI) 1.10 to 1.34). In another large postal survey conducted during 1997 through 1999, 12,049 Seabees (3,831 Gulf War veterans)<sup>(45)</sup> who served during the Gulf War period were asked to complete questionnaires regarding their hospitalizations since 1990. Thirty-eight percent of Gulf War veterans and thirty-five percent of non-deployed veterans reported one or more hospitalizations.



Studies of Gulf War exposures and postwar hospitalizations.

DoD hospitalizations were additionally studied for evidence of Gulf War-related morbidity from possible chemical warfare exposures. Geographic and weather models were used to identify US Army soldiers possibly exposed to a nerve agent when a cache of nerve-agent laden rockets were destroyed after the war near Khamisiyah, Iraq, in March 1991. Although no evidence of acute nerve agent toxicity was documented, concern was raised regarding possible latent morbidity from subclinical nerve agent exposure. Using multivariate models, the postwar hospitalization experience of 348,291 US Army Gulf War veterans was studied through September 30, 1995.<sup>(46)</sup> Possibly exposed Gulf War veterans were not found to be at increased risk of hospitalization for any cause, for diagnoses in any one of 15 ICD-9 large categories, or for diagnoses thought most likely to be associated with latent manifestations of subclinical nerve agent exposure.

OIL WELL HERE

Hospitalization studies, while not yielding evidence of a Gulf War syndrome or unusual Gulf War-related diagnoses, have demonstrated some increased risk of hospitalization among Gulf War veterans, particularly for mental health diagnoses and injuries. Data have also revealed that the most important predictors of postwar hospitalization are female gender, prewar hospitalization, healthcare occupation, enlisted rank, service in the Army, and low rank.<sup>(36, 38, 46)</sup> These studies have revealed the importance of considering numerous covariates when conducting future post-deployment research.

OUTPATIENT VISITS

In-theater outpatient visits.

A number of self-administered questionnaire surveys of US military personnel serving in the Gulf War theater were conducted before the fighting began. Richards et al.<sup>(47)</sup> surveyed 2,598 US military combat personnel serving in Saudi Arabia during September through December 1990 and found that respiratory disease symptoms were a frequent complaint. Among respondents, 43.1% complained of cough, 34.4% reported a sore throat, and 15.4% complained of chronic rhinorrhea. Hyams and colleagues<sup>(48)</sup> surveyed 2,022 soldiers stationed in various regions of Saudi Arabia during late 1,990. They found that with an average stay of only 2 months, 57% had at least one incident of diarrhea and 20% reported that diarrhea kept them from conducting their duties. Respiratory disease and diarrhea disease were similar common problems among deployed shipboard personnel.<sup>(49)</sup> The impact of infectious diseases upon Gulf War veterans is well described in two thorough reviews.<sup>(50, 51)</sup>

### Postwar outpatient visits.

Relatively few controlled studies of postwar ambulatory care visits have been conducted among Gulf War veterans. This is due mainly to the lack of useful electronic outpatient records. The VA has electronic outpatient data (Outpatient Care File) available back to 1980, but the data lacked key epidemiological elements until improvements were made in 1996.<sup>(52)</sup> Similarly, outpatient electronic data (Standard Ambulatory Data Record) first became available for DoD health care facilities in 1996. Neither of these systems has been evaluated for use among Gulf War veterans and their peers.

A number of healthcare utilization reports are available from the Gulf War deployment period. Most are based on unofficial records and none include non-deployed controls. Hines<sup>(53)</sup> studied 10,165 ambulatory visits from an armor division during the Gulf War. He concluded that while women occasionally have needs that merit the care of a gynecologist, more broadly trained clinicians were usually well equipped to provide female soldier care. In a 1997 review article, Murphy et al.<sup>(54)</sup> came to similar conclusions but recommended better studies of gender-specific morbidity.

Hines<sup>(55)</sup> studied the 15,401 ambulatory visits made by Army personnel during 6 months of the Gulf War. He empirically created seven morbidity categories and compared male and female soldiers. He found that men were more likely to be seen for orthopedic or dermatological conditions, and women were more likely to be evaluated for psychiatric and optometric problems. Considering all visits of both male and female soldiers, ambulatory visits were most common for orthopedic problems (30.3%), respiratory problems (24.9%), and dermatological problems (13.9%). In a review of 6,772 visits among an US Army armored cavalry unit, Wasserman et al. (56) similarly found a high proportion of orthopedic, gastrointestinal, and respiratory problems among ambulatory visits during the Gulf War. Shaw et al.<sup>(57)</sup> found that among 1,820 medical encounters at two deployed Navy Fleet Hospitals, most frequent were injury category diagnoses (24%) and respiratory disease diagnoses (19%). Perhaps the most comprehensive in-theater ambulatory care evaluation was performed by Hyams, et al.<sup>(51)</sup> in conducting surveillance of ambulatory visits among 40,000 Marines stationed in northeastern Saudi Arabia. They found that gastroenteritis and acute respiratory track infections were most common. A gastroenteritis outbreak was abated after local fruits and vegetables were banned. A key element of success in determining the cause of diarrheal disease in the Gulf War theater was the availability of advance laboratory support.<sup>(58)</sup> They also noted that respiratory disease outbreaks occurred soon after large groups of deployed personnel arrived in theater.

### Outpatient visits as captured by cross-sectional survey.

Another approach to evaluate ambulatory morbidity among Gulf War veterans has been to perform surveys of postwar healthcare utilization. In 1995, Stretch et al.<sup>(59)</sup>

reported a postal survey of 4,334 Gulf War veterans and their non-deployed peers finding that both active-duty and Reserve Gulf War veterans reported a higher prevalence than their non-deployed peers of visiting a physician within two weeks of completing the survey.

Similarly, in a 1998 report,<sup>(60)</sup> 3,113 Canadian Gulf War veterans and 3,439 non-deployed veterans were surveyed for contacts with healthcare professionals, hospital emergency room visits, and hospital admissions during the previous 12 months. The investigators found no evidence for increased healthcare visits but Gulf War veterans did report more nonprescription drug use and more medical conditions. Kang et al.<sup>(44)</sup> reported in their survey of more than 20,000 US Gulf War era service personnel that the Gulf War veterans reported more outpatient and inpatient visits than did their peers and they had more functional impairment, symptoms, and self-reported medical conditions.

## URANIUM EXPOSURE HERE

While available data are not without problems, in general outpatient data suggest that Gulf War veterans are seeking healthcare more often than their non-deployed peers.

## ONGOING RESEARCH

A number of studies are in progress to further examine healthcare utilization and diagnoses among Gulf War veterans. In a DoD and VA collaborative study, data from more than 120,000 participants in the two Gulf War veteran clinical registries will be analyzed for a more comprehensive understanding of the spectrum of illnesses among Gulf War veterans. In addition, the Uniformed Services University of Health Sciences (Bethesda, MD) is collaborating with the King Fahad National Guard Hospital (Riyadh Saudi Arabia), Naval Health Research Center (San Diego, CA), Centers for Disease Control and Prevention (Atlanta, GA), and DoD's Office of the Special Assistant for Gulf War Illnesses (Falls Church, VA) in examining the postwar healthcare utilization of Saudi National Guard Gulf War veterans compared with their Saudi National Guard colleagues who did not see combat. Finally, Naval Health Research Center, in collaboration with multiple DoD organizations, is comparing post-deployment morbidity between US veterans of the Gulf War and veterans of peacekeeping efforts in Southwest Asia and Bosnia.

## DISCUSSION

Data from the Gulf War veteran health registries are influenced by self-selection bias and, as a result, are not representative of the entire Gulf War veteran population. Similarly, electronic hospitalization data were designed for administrative purposes and their use in epidemiological studies is not without problems.<sup>(61)</sup> Finally, self-reported data is understood to have many potential biases. McCauley et al.<sup>(62)</sup> found poor

validity and reliability in self-reported Gulf War exposures. Thus the reports we have summarized have considerable limitations but considered together lead us to a number of conclusions.

To date, the health registries and healthcare related epidemiological studies have failed to identify a unique constellation of symptoms or clinical signs that could be termed a "Gulf War syndrome." Instead, they demonstrated that the illnesses Gulf War veterans were suffering were similar to those experienced by other veterans, both historically and at present.<sup>(63)</sup> These studies have contributed much to reduce the anxiety related to alleged Gulf War related morbidity (Figure 1). Today, most studies have shown that Gulf War veterans are not suffering unexplained mortality, cancers, unusual hospitalizations or from chronic diseases any more than their non-deployed peers. Most researchers currently recognize that the conditions most strongly associated with Gulf War service are those involving unexplained symptoms. Hence, the focus on present and future medical research among Gulf War veterans and other military populations has shifted to testing empirical treatments<sup>(64,65)</sup> proved effective among other populations suffering from symptom-based conditions and to evaluating how the health of Gulf War veterans changes over time.<sup>(66)</sup> A large population-based study<sup>(67)</sup> is being planned to follow the health of Gulf War veterans and other US military personnel over the next 20 years.

## **CONCLUSIONS AND FUTURE RESEARCH NEEDS**

Gulf War veterans have suffered a wide range of health problems since returning from the war. However, health care registry data and epidemiological studies of health-care utilization have revealed no unique Gulf War syndrome. Instead, they have demonstrated conditions similar to those affecting other military and adult populations, often with no identified increase in risk. However, regarding multi-symptom conditions, Gulf War veterans do seem to be suffering increased morbidity and to be using healthcare services more than their peers. Such multi-symptom conditions are now the focus of significant research.

In addition to evaluating possible therapies for multi-symptom conditions, federal research should now focus on identifying risk factors for the development of post-deployment symptom-based conditions. In fact, plans are in progress to evaluate pre-deployment screening strategies to identify new military members at greatest risk of post-deployment symptom-based illness.<sup>(68)</sup> Such risk factor identification is necessary to guide future preventive efforts to reduce post-deployment morbidity.

## **ACKNOWLEDGEMENTS**

Dr. Gray was formerly Director of the Center for Deployment Health Research, at Naval Health Research Center, San Diego, CA; which an early draft ( dated 7-31-00) of this manuscript was prepared.

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Table 1. Special Gulf War veteran health evaluations.

<b>Sponsor</b>	<b>Registry Name</b>	<b>Start Date</b>	<b>Number of Veterans Evaluated as of June 2000</b>	<b>Number Deployed</b>
United States Department of Veterans Affairs	Persian Gulf Veterans Health Registry (6)	August 1992	70,000+	697,000
United States Department of Defense	Comprehensive Clinical Evaluation Program (7)	June 1994	53,000+	
United Kingdom Ministry of Defence	Gulf War Medical Assessment Programme (8)	July 1993	3,000+	53,000
Canada Department of National Defence	Canadian Gulf War Registry (9)	January 1995	226+	4,500

Table 2. Prevalence of frequently reported symptoms, by Gulf War veteran registry.

Symptom	US Department of Veterans Affairs (19) (n = 52,835)	US Department of Defense (n = 53,032)*	United Kingdom (n = 1000)(8)	Canada (n = 104)†
	Symptom prevalence (%)			
Fatigue	20.5	37.2	42.1	86.5
Skin rash	18.4	24.0	19.4	47.1
Headache	18.0	32.7	25.6	65.4
Muscle and joint pain	16.8	40.9‡	39.5	75.0
Cognitive problems	14.0	33.5**	26.1	84.6
Shortness of breath	7.9	19.0	24.3	33.0
Sleep disturbance	5.9	29.1††	21.2	74.0
Diarrhea and other gastrointestinal	4.6	27.0 ‡‡	21.8	55.8
No complaint	12.3	41.1***	7.4	0

\*As of May 31, 2000.

† From 104 veterans evaluated at Ottawa's Gulf War Clinic April 1995 to December 1997.

‡ Answered "yes" to "muscle pain," "joint pain," or both.

\*\* Answered "yes" to "difficulty concentrating," "memory loss," or both.

†† Answered "yes" to any of the following: "sleep disturbance," "loud snoring," or "stopped breathing while sleeping."

‡‡ Answered "yes" to "abdominal pain", "diarrhea", or both.

\*\*\*Did not answer "yes" to 18 questions about symptoms including "Do you have any other symptoms?"

Table 3. Percent distribution of selected diagnoses for Gulf War veterans participating in a health registry

Diagnoses		US Department of Veterans Affairs* (n = 69,941)	US Department of Defense† (n = 53,032)
Diagnoses	ICD-9 code‡	% of diagnoses	
None	**	27.0	29.5
Malaise and fatigue	780.7	22.0	8.4
Headache	784.0	21.0	6.2
Pain in joint	719.4	13.2	12.7
Sleep disturbances	780.5	7.9	7.9
Depressive disorder, not elsewhere classified	311	4.1	4.9
Lumbago	724.2	4.0	6.1
Psychalgia	307.8	3.9	7.7
Other specified adjustment reactions	309.8	3.9	3.6
Essential hypertension, unspecified	401.9	3.6	2.8
Contact dermatitis and other eczema, unspecified cause	692.9	3.6	2.6
Unspecified sinusitis (chronic)	473.9	3.2	1.9

Other and unspecified noninfectious gastroenteritis and colitis	558.9	2.8	1.5
Asthma, unspecified	493.9	2.7	2.5
Migraine, unspecified	346.9	2.6	3.8
Allergic rhinitis, cause unspecified	477.9	2.5	3.4
Anxiety states	300.0	2.4	1.7
Osteoarthritis, unspecified	715.9	2.2	4.4
Alopecia	704.0	2.1	2.4
Irritable colon	564.1	1.9	3.7

\* In the VA registry a special non-ICD-9 code "DX111" was used as well as ICD-9 code V65.5 (person with feared complaint in whom no diagnoses were made) to indicate veterans with no diagnoses. All are considered as missing.

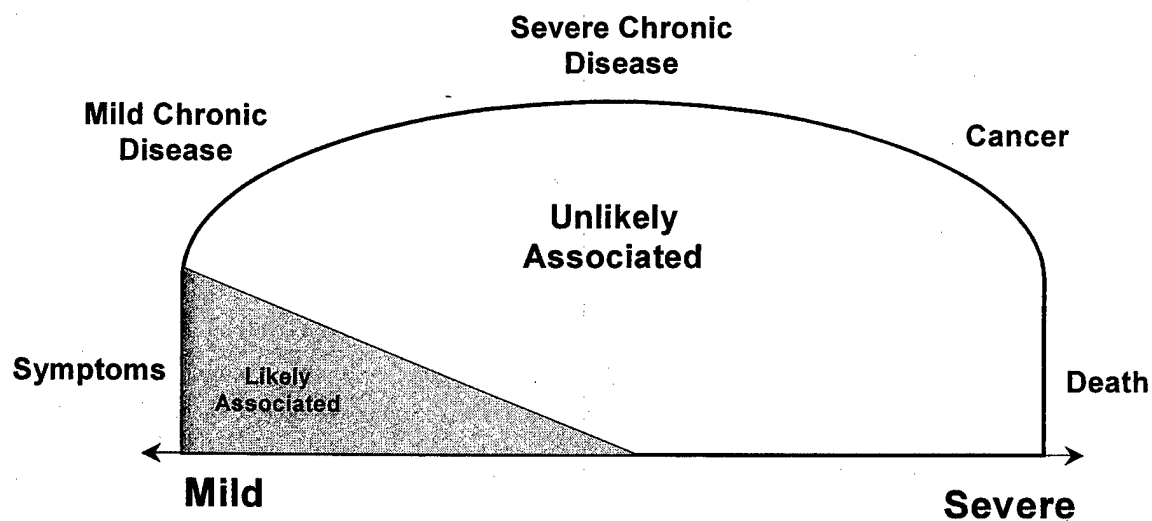
† Percentage of 69,941 Gulf War veterans who completed the VA registry examination as of September 30, 1999.

‡ 4-digit code from *International Classification of Diseases, Ninth Revision, Clinical Modification, 3rd Edition* (29).

\*\* Data as of May 30, 2000 – Diagnoses were reported in the any of the primary or 6 secondary diagnostic fields. A code of "xxx.xx" was interpreted as missing.

### LEGEND

Figure 1. Health registry studies and epidemiological studies have demonstrated no unique Gulf War syndrome and no increased risk among Gulf War veterans of unexplained mortality, cancer, severe chronic disease, or mild chronic disease. However, it is apparent that Gulf War veterans are suffering from increased symptoms and this spectrum of morbidity is now the focus of much federal research.



## REPORT DOCUMENTATION PAGE

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<b>1. Report Date (DD MM YY)</b> 13 Jul 2000	<b>2. Report Type</b> New	<b>3. DATES COVERED (from - to)</b> 1996 to Feb 200
<b>4. TITLE AND SUBTITLE</b> Gulf War Veteran Healthcare Utilization: After more than 10 years of study, what have we learned?		<b>5a. Contract Number:</b> <b>5b. Grant Number:</b> <b>5c. Program Element:</b> 63738D <b>5d. Project Number:</b> P4464 <b>5e. Task Number:</b> 001 <b>5f. Work Unit Number:</b> 60002
<b>6. AUTHORS</b> Gregory C. Gray, Gary D. Gackstetter, Han K. Kang, John T. Graham, & Ken C. Scott		<b>9. PERFORMING ORGANIZATION REPORT NUMBER</b> Report 00-26
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> Naval Health Research Center P.O. Box 85122 San Diego, CA 92186-5122		
<b>8. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> Chief, Bureau of Medicine and Surgery M2 2300 E St NW Washington DC 20372-5300		<b>10. Sponsor/Monitor's Acronyms(s)</b> BUMED
		<b>11. Sponsor/Monitor's Report Number(s)</b>

**12 DISTRIBUTION/AVAILABILITY STATEMENT**  
Approved for public release; distribution unlimited.

### 13. SUPPLEMENTARY NOTES

### 14. ABSTRACT (maximum 200 words)

Purpose: To review clinical and epidemiological studies of morbidity among Gulf War veterans, specifically those involving special healthcare registries, hospitalizations, and outpatient visits.  
Data Sources: MEDLINE, Reports to Congress, and a topical Gulf War veteran bibliography were used to identify published research, ongoing research, expert panel reviews, and case reports relevant to the objective.  
Study Selection: Studies published in peer-reviewed medical journals.  
Data Extraction: Published reports are reviewed and findings summarized.  
Data Synthesis: Study approaches and findings are summarized and considered in aggregate. Additional studies are considered.  
Conclusions: Published health registry studies and healthcare-related epidemiological research have reduced speculation, increased Gulf War veterans access to care, and helped to rule out severe war-related morbidity. In addition, they have guided empirical therapies for the excessive number of Gulf War veterans suffering from symptom-based conditions.

### 15. SUBJECT TERMS

Veteran Healthcare Utilization, Gulf War Veterans, healthcare registries, hospitalizations, outpatient visits

<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>	<b>18. NUMBER OF PAGES</b>	<b>19a. NAME OF RESPONSIBLE PERSON</b>
<b>a. REPORT</b> UNCL	<b>b. ABSTRACT</b> UNCL	<b>b. THIS PAGE</b> UNCL	UNCL	21	Commanding Officer
					<b>19b. TELEPHONE NUMBER (INCLUDING AREA CODE)</b> COMM/DSN: (619) 553-8429